International Journal of Pharmaceutical and Bio-Medical Science

ISSN(print): 2767-827X, ISSN(online): 2767-830X

Volume 05 Issue 03 March 2025

Page No : 163-169

DOI: https://doi.org/10.47191/ijpbms/v5-i3-03, Impact Factor: 8.163

Evaluation of Aphrodisiac Potentials of *Corchorus Olitorius* Leaves and Stem Ethanolic Extracts in Male Wistar Rats

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ABSTRACT

Aside from the acclaimed rich nutritional constituents of *Corchorus Olitorius* plant (commonly called Ewedu in Yoruba language), there are anecdotal claims of its possible aphrodisiac potentials. Thus, the present study sets out to evaluate the aphrodisiac potentials of ethanolic extracts *of Corchorus olitorius* (Ewedu) leaves and stems in male Wistar rats. Twenty four (24) adult male and ten (10) adult female (for the sake of mating activities only with no treatments) Wistar rats weighing between 160g and 180g were obtained for the study and housed in the animal house facility of department of human physiology, Rivers State University. The study models were randomly distributed into six different groups of 4 male rats each: Group 1 served as normal control and received 1ml normal saline daily, Group 2 served as standard control and received 5mg/kg body weight (b.w) of sildenafil citrate (at least an hour prior to the start of the experiment), Groups 3 (a) 3 (b) received 500mg/kg bw of the *Corchorus Olitorius* leaf and stem extracts respectively, Groups 4 (a) and 4 (b) received 1000mg/kg bw of *Corchorus Olitorius* leaf and stem extracts respectively. At the end of the respective treatments, the sexual behavior test was carried out on the study models. And numerical data derived from the study were subjected to statistical analyses using the statistical package for social sciences software (SPSS) version 25.0. The results revealed that the leaf and stem portions of the Ewedu plant are capable of significantly ($p<0.05$) raising mount frequency (MF), intromission frequency (IF), ejaculation frequency (EF) and ejaculation latency (EL) values in the treated study models and the manner was similar to that of a standard drug (Sildenafil citrate, a known phosphodiesterase (PDE) inhibitor that treats erectile dysfunction). The study also recorded significant ($p<0.05$) decreases in the post-ejaculatory interval (PEI) durations of the study models treated with low and high doses of the both extracts. In conclusion, the leaf and stem portions of the *Ewedu* plant can be said to enhance sexual desire and copulation performance and outcomes thus indicating their aphrodisiac attributes of potentially improving libido, potency and sexual pleasure.

KEYWORDS: Corchorus Olitorius plant; aphrodisiac potentials; ethanolic extracts; male reproductive system; Ewedu

ARTICLE DETAILS

Published On:
07 March 2025

Available on:
https://ijpbms.com/

INTRODUCTION

Reproductive health dysfunction has been recorded as one of the most prevalent health care complications in Africa (Kamatenesi-Mugisha & Oryem-Origa, 2005). In fact, apart from social challenges, biological challenges such as sexual dysfunction are often times at the center of many poor sexual outcomes (Hayes et al., 2008). When such a problem lingers, it can pose a lot of difficulty on couples (McCabe et al., 2016; Meana et al., 2023). In such instances, the use of natural products has been hugely relied upon and perceived as very

potent amongst other therapeutic approaches (Chen et al., 2019; Leisegang & Finelli, 2021).

Subsequently, a number of herbal plants (*Allium cepa, Allium sativum, Garcinia cola and Cola acuminate*, etc) with aphrodisiac potentials have been noted in our clime (Nwafor et al., 2020; Odukoya et al., 2022). In addition, *Corchorus olitorius* (*Ewedu* or Jute plant) has also been faintly implicated as possessing aphrodisiac attributes (libido enhancing and erectile dysfunction improvement) (Eshemokha, 2020). Thus, considering the popular and wide consumption of the *Ewedu* leaf in a local delicacy—*Ewedu soup* (Olugbuyi et al., 2023), it becomes a good candidate to properly investigate for such and other benefits.

The *Ewedu soup*, which is made from the jute plant (*Corchorus olitorius*), is popularly consumed by the Yoruba people and other ethnic groups in Nigeria/some neighboring countries, as a traditional local dish. (Okorejior et al., 2024). The plant is a member of the genus *Olitorius*, which includes numerous flowering plant species in the Malvaceae family. Around the world, it is indigenous to tropical and subtropical regions (Akinwande et al., 2024; Olatunde, 2024).

This leafy green vegetable is reported to be high in calcium for strong bones and teeth, iron for healthy red blood cells, beta-carotene for good vision, and vitamin C for clear, smooth skin, etc. The plant's vitamins A, C, and E content have also been implicated in counteracting free radicals, thus promoting healthy cellular functions (Eshemokha, 2020). Definitely, such attributes of a plant should be endowed with possible beneficial biological effects (Awuchi, 2019; Eshemokha, 2020). Thus, in view of the craving by many couples for natural and safe aphrodisiac agents (Puri & Puri, 2011; Leonti & Casu, 2018), the male reproductive system readily comes to mind.

The male reproductive system that is primarily made up of the testes and the external genitalia with their connections, produce the sperm cells which are the male reproductive cells (Mawhinney and Mariotti, 2013; Gurung et al., 2023). The system also stabilizes and transports the sperm cells in seminal fluid into the female genitals for fertilization. The system also produces and secretes male sex hormones (mainly testosterone) (Creasy & Chapin, 2013). Further, a number of factors including infections, genetic disorders, environmental conditions, and lifestyle changes have been linked to dysfunction of the male reproductive system (Kumar et al., 2014).

Considering the importance and delicate nature of the male reproductive system as well as the possible effects of the aforementioned conditions, the present study sets out to evaluate the aphrodisiac potentials of ethanolic extracts *of Corchorus olitorius* (*Ewedu*) leaves and stems in male Wistar rats.

MATERIALS AND METHODS

Plant collection

Fresh leaves and stems of *Corchorus Olitorius* (Ewedu plant) were obtained from Rivers State University farm located in Port Harcourt, Nigeria. A voucher sample was deposited in the herbarium located in the Department of Plant Science and Biotechnology of the Rivers State University for proper identification and authentication. The rest of the plant samples were sorted out, washed and air-dried for twenty two days. Thereafter, the dried leaves and stems were separately pulverized into fine powder using electric grinder.

Preparation of Plant Extract

The fine powders of the leaves and stems were then separately soaked in 80% ethanol solvent. The ratio of plant sample to solvent volume for the two different plant portions was 40g: 2500ml. The mixtures were periodically shaken at regular intervals to achieve maximum extraction. After 72 hours, the solution was filtered using Whatman No. 1 filter paper. And then, the filtrate was concentrated in water bath at 40^{o}C. The dried semi-solid extracts of the leaves and stems of the plant were then weighed and kept in the fridge at about 4^{O}C until when they were used.

With reference to the report of Egua *et al.,* (2014), which stated that the LD50 of the ethanolic extract of the same plant was over 5000mg/kg, 500mg/kg (low dose) and 1000mg/kg (high dose) were adopted as effective doses for the present study.

The respective extracts (leaf and stem) of *Corchorus Olitorius* were orally administered; hence the extract was suspended in normal saline. Similarly, considering the appropriate dose for the study models, sildenafil citrate and estradiol valerate were also suspended in distilled water for oral administration.

Study models and their handlings

Twenty four (24) adult male and ten (10) adult female (for the sake of mating activities only with no treatments) Wistar rats weighing between 160g and 180g were obtained for the study and housed in the Animal House unit of the Department of Human Physiology, Faculty of Basic Medical Sciences, Rivers State University, Nigeria. Standard cages were used and the models were maintained under the 12hr light/dark cycle with free access to feeds and water throughout the study. The route of all drug administration was oral using the oral gavage.

Experimental Protocol

The study models were randomly distributed into six different groups of 4 male rats each:

1. Group 1 served as normal control and received 1ml normal saline daily,
2. Group 2 served as standard control and received 5mg/kg body weight (b.w) of sildenafil citrate (at least an hour prior to the start of the experiment

3. Groups 3 (a) served as test group and received 500mg/kg bw of the *Corchorus Olitorius* leaf extract.
4. Groups 3 (b) served as test group and received 500mg/kg bw of the *Corchorus Olitorius* stem extract.
5. Groups 4 (a) served as test group and received 1000mg/kg bw of *Corchorus Olitorius* leaf extract.
6. Groups 4 (b) served as test group and received 1000mg/kg bw of *Corchorus Olitorius* stem extract.

Mating Test

The male sexual behaviour test was carried out by the modified method of Agmo (1997).

The female rats were artificially brought into oestrus (heat) by the method of Szechtman et al., (1981); thus, the female rats were treated with suspension of estradiol valerate orally at a dose of 500ug/kg body weight and progesterone injected subcutaneously at a dose of 5mg/kg bw. The procedures lasted 3-4 hours daily for 3 days. Recall that rats are nocturnal and are therefore most active at night. Thus, dark and quiet rooms with red light illumination were prepared for the experiment. On introduction of the male rats into the dark rooms, they were allowed 10 minutes for adaptation period. Thereafter, a receptive female rat was silently dropped into the same dark room with the male rat as stimulus (the ratio was 1 female to 1 male). The occurrence of events and phases of mating were recorded by a pre-mounted digital camera in real time. At the end of the mating activities, with the aid of a stopwatch, the frequencies and phases were recorded manually by careful observation of the events recorded by the digital camera.

The following parameters of sexual behavior were measured as previously described by Agmo,(1997) and Gauthaman et al., (2002):

1. Mount latency (ML): time from the introduction of the female until the first mount
2. Intromission latency (IL): time from introduction of the female to the first intromission (vaginal penetration)
3. Ejaculation latency (EL): time from the first intromission to ejaculation
4. Post-ejaculatory interval (PEI): time from ejaculation to the first intromission of the second copulatory series
5. Mount frequency (MF): number of mounts preceding ejaculation
6. Intromission frequency (IF): number of intromissions preceding ejaculation.
7. Ejaculation frequency (EF): number of ejaculations in a copulatory series.

Statistical analysis

Numerical data derived from the study were subjected to statistical analyses using the statistical package for social sciences software (SPSS) version 25.0. The analysis of variance (ANOVA) followed by LSD Post Hoc tests were used. The values were expressed as mean ± standard error of mean (Mean ± SEM). Statistical significance was determined at p-value less than 0.05 ($p < 0.05$).

RESULTS

Table 1: Effect of Ethanolic Leaf Extract of *Corchorus Olitorius* on Sexual Behaviour in male Wistar rats.

	Study Groups					
Sexual Behaviour	**Control**	**Standard Drug (Sildenafil Citrate) Treated**	**Low Dose (LDELE) Treated**	**High Dose (HDELE) Treated**	**F**	**p-value**
ML (s)	17.50 ± 2.5	12.5 ± 2.5	24.0 ± 1.0*[a]	15 ± 5.0[a]	2.53	0.03
MF (n)	2.0 ± 1.0	14 ± 1.0*	7.5 ± 0.5*[a]	6.5 ± 1.5[a]	21.78	0.01
IL (s)	21.5 ± 1.5	13.5 ± 1.5*	21.5 ± 1.5	22.5 ± 2.5	5.41	0.07
IF (n)	4.0 ± 1.0	16.0 ± 1.0*	11.0 ± 1.0*[a]	9.0 ± 1.0*[a]	24.67	0.01
EL (s)	125.0 ± 5.0	186.5 ± 3.5*	181.5 ± 1.5*	176.0 ± 1.0*	80.17	0.00
EF (n)	1.0 ± 0.0	4.5 ± 0.5*	3.5 ± 0.5*	3.0 ± 0.0*	17.33	0.01
PEI (s)	391.0 ± 6.0	164.6 ± 14.0*	323.5 ± 3.5*[a]	332.5 ± 2.5*[a]	150.93	0.00

Values were expressed as mean ± standard error of mean (Mean ± SEM).

HDELE = High Dose Ewedu (*Corchorus Olitorius*) Leaf Extract.

LDELE = Low dose (*Corchorus Olitorius*) Ewedu Leaf Extract.
MF = Mount frequency, ML = Mount latency, IF = Intromission frequency, IL = Intromission latency, EF = Ejaculation frequency, EL = Ejaculation latency, PEI = post ejaculatory interval.

*Signifies significant difference (P ≤0.05) in comparison with control group
[a]Signifies significant difference (P≤0.05) in comparison with sildenafil citrate group

The data on Table 1 shows the effect of ethanolic leaf extract of *Corchorus olitorius* on sexual behaviour in male Wistar rats.
The low and high doses of the extract indicated significantly (p<0.05) raised and low respective durations of mounting latency (ML) when compared to that of the control group.
The mount frequencies (MF) in all test groups were seen to significantly (p<0.05) increased when compared to that of the control group. More so, the standard drug treated group had markedly risen (p<0.05) level when compared to that of the extract treated groups.
The intromission latency (IL) was marginally highest (p>0.05) in the high dose extract treated group when compared to all other groups. But the standard drug treated group had significantly (p<0.05) reduced IL duration when compared to that of the control group.
The intromission frequency (IF), ejaculation latency (EL) and ejaculatory frequency (EF) were seen to be significantly (p<0.05) increased in all treated groups when compared to that of the control group. Further, these parameters were higher in the standard drug treated group when compared to those of the extract treated groups.
The post ejaculatory interval (PEI) was found to be more significantly (p<0.05) reduced in the test groups when compared to that of the control group. These decrease in the PEI of the test groups were seen to be significantly least in the standard drug treated group.

Table 2: Effect of *Corchorus Olitorius* Stem on Sexual Behaviour of Wistar rats

	Study Groups					
Sexual Behaviour	**Control**	**Standard Drug (Sildenafil Citrate) Treated**	**Low Dose (LDELE) Treated**	**High Dose (HDELE) Treated**	**F**	**p-value**
ML (s)	17.5 ± 2.5	12.5 ± 2.5	10.0 ± 0.0*	22.5 ± 2.5[a]	9.44	0.02
MF (n)	2.0 ± 1.0	14.0 ± 1.0*	7.7 ± 1.5*[a]	6.5 ± 1.5[a]	11.58	0.01
IL (s)	21.5 ± 1.5	13.5 ± 1.5	20.7 ± 6.2	30.5 ± 2.5	1.95	0.24
IF (n)	4.0 ± 1.0	16.0 ± 1.0*	11.0 ± 1.0*[a]	11.0 ± 1.0*[a]	20.31	0.00
EL (s)	125.0 ± 5.0	186.5 ± 3.5*	170.7 ±4.6*	176.5 ±3.5*	32.83	0.00
EF (n)	1.0 ± 0.0	4.5 ± 0.5*	3.3 ± 0.3*	3.5± ± 0.5*	13.22	0.01
PEI (s)	391.0 ± 6.0	164.6 ±14.0*	321.7 ±6.1*[a]	330.0 ±2.0*[a]	136.25	0.00

Values were expressed as mean ± standard error of mean (Mean ± SEM).
HDELE = High Dose Ewedu (*Corchorus Olitorius*) Leaf Extract.

LDELE = Low dose (*Corchorus Olitorius*) Ewedu Leaf Extract.
MF = Mount frequency, ML = Mount latency, IF = Intromission frequency, IL = Intromission latency, EF = Ejaculation frequency, EL = Ejaculation latency, PEI = Post ejaculatory interval.
*Signifies significant difference (P ≤0.05) in comparison with control group
[a]Signifies significant difference (P≤0.05) in comparison with sildenafil citrate group

Table 2 displays the effect of *Corchorus Olitorius* stem on sexual behaviour of Wistar rats.

The ML time for the high dose treated group was the highest when compared to that of all other groups. It was significantly raised when compared to that of the standard drug treated group.

The MF count for both the standard drug and low dose extract treated groups were remarkably ($p<0.05$) higher when compared to that of the control group; but the MF of the low dose was significantly lower when compared to that of the standard drug treated group.

Concerning the IL, there was no significant ($p>0.05$) variation when the values of the extract treated group were compared to those of the control and standard drug treated groups. But the IL time for the high dose treated group was most with respect to all others.

Both the IF and EL values of all test groups were significantly ($p<0.05$) higher in the test groups when compared to that of the control group. Notably, the IF value was remarkably higher in the standard drug treated group when compared to those of the extract treated groups.

The EF was found to be significantly raised in the test groups when they were respectively compared to that of control group.

Considering the PEI changes, it was markedly ($p<0.05$) reduced in all test groups when compared to that of the control group. The PEI value of the standard drug treated group was significantly ($p<0.05$) reduced when compared to that of the extract treated group.

DISCUSSION

Aphrodisiacs are understood to be potent in improving libido, potency and sexual pleasure (Bubnova & Galchenko et al., 2024). And long standing history has it that, there has been a great enthusiasm in the search for a cure or medication that is capable of improving sexual function and/or treat male erectile dysfunction (Shamloul et al., 2010). Consequently, the present study evaluated the possible actual aphrodiasiac potential of Ewedu (*Corchorus olitorius*) plant leaf and stem and the main outcomes are as discussed in the following paragraphs.

One of the major findings of the present study revealed significant increases in MF and IF in the low and high doses of Ewedu leaves and stem treated study models. These attributes from the study extract is indicative of possible enhancement of sexual desire and better sustained penile erection. This notion is consistent with the earlier reports by Ratnasooriya and Dharmasiri (2000) Yakubu & Afolayan (2009) (that used other similar agents); they stated that increase in the number of mounts (MF) reflects sexual motivation while raised intromission frequency shows efficiency of erection and penile orientation.

The MF and IF as well as the EF and EL were found to be markedly raised in test groups as compared to the control group; even though the standard drug (sildenafil citrate) treated models had higher values, those of the leaf and stem extract groups have shown a similar pattern like the former. This

Of course, it is known that by boosting blood flow to the penile tissues during sexual stimulation, sildenafil helps treat erectile dysfunction as it results in erection (Bocchi et al., 2022). From the foregoing, it is thus indicative to state that the leaf and stem extract of the Ewedu plant could have constituents that may be acting in like manner with that of the standard drug. Consequently, it is suggested that further study to characterize the active ingredients of the plant portions be done; as to precisely predict the actual nature and efficacy of such active compounds in the plant.

The markedly reduced mount latency (ML) recorded for both the standard drug and the extracts in the present study is revealing that the plant portions, even at the low dose, may stimulate sexual motivation and arousal. This thought holds true as it is known that longer mount latency denotes a delay in the male's sexual arousal or copulation readiness (Hull *et al.*, 2002). Thus, the constituents of the plant portions under study may be potent aphrodisiac.

The ejaculation latency (EL) duration for both extracts of the plant, like that of the standard drug, was significantly increased when compared to the control group's value. It is thus indicative that the leaf and stem of the Ewedu plant may have the ability to prolong the duration of coitus, thus possibly enhancing copulation performance. This finding thus validates anecdotal or tradomedical claim that the plant is a possible aphrodisiac agent. It also implies that the plant has aphrodisiac effect. This outcome is synonymous to that of an earlier study by Wattanathorn et al., (2012) who worked on a similar plant *Kaempferia parviflora*.

The present study recorded significant decreases in the PEI durations of the study models treated with low and high doses of the both extracts. Post ejaculatory interval is considered as the time interval between one phase of ejaculation to another; here the male is not readily able to achieve another erection or ejaculate. It is thus a refractory period (Turley & Rowland, 2013). Therefore, the marked reduction as recorded in the present study is suggestive that the possible active ingredients in extracts may truly be potent in sustaining coitus and possibly increasing the number of ejaculations.

CONCLUSION

The present study has revealed that the leaf and stem portions of the *Ewedu* plant are capable of significantly raising MF, IF, EF and EL values in the treated study models and the manner was similar to that of a standard drug (Sildenafil citrate, a known phosphodiesterase (PDE) inhibitor that treats erectile dysfunction). Again, the study recorded significant decreases in the PEI durations of the study models treated with low and high doses of the both extracts. In most cases of the aforementioned outcome, the effects of the plant were in

a dose—dependent fashion. In conclusion, the leaf and stem portions of the *Ewedu* plant can be said to enhance sexual desire and copulation performance and outcomes thus indicating their aphrodisiac attributes of potentially improving libido, potency and sexual pleasure. Therefore, to accurately predict the true nature and effectiveness of such active compounds in the plant, it is recommended that more research be done to characterise the active ingredients of the plant portions.

ACKNOWLEDGEMENTS

This work was carried out in collaboration among all authors. All authors read and approved the final manuscript.

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